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1991 Feature Article - Is the Consumer Price Index Series Seasonal? OVERVIEW

With each release of the quarterly CPI there is discussion about how much of the "inflation" measure has been due to seasonal factors. Much of this discussion has been based on conjecture, and the purpose of this paper is to present the empirical evidence of the CPI's time series characteristics.

TIME SERIES DECOMPOSITION

1. Conceptually the movements in the CPI are attributable to three notional influences, each interacting with the others and having its own distinguishing characteristics. The three factors are:

- Seasonal influences;
- Trend movements;
- Residual/irregular factors.

2. These concepts are illustrated in Graph 1(referred to as a Shiskin graph). Chart 1 of Graph 1 shows the behaviour of the original quarterly data over the period September 1980 to September 1990/ Clearly this series does not display a strong seasonal or residual/irregular variation in its quarter to quarter movements; its movements are relatively smooth. Typically, the relative contribution of the seasonal patter, residual/irregular influences and trend to the quarterly variability is respectively 1%, 1% and 98%. Charts 2, 4 and 5 account for this variation as discussed in this paper.

Graph 1. CONSUMER PRICE INDEX (a)

Chart 1. ORIGINAL SERIES

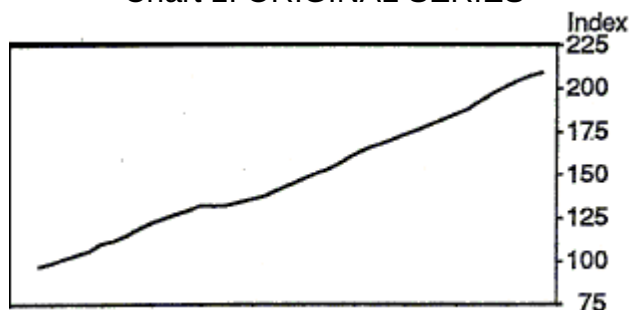


Chart 2. SEASONAL VARIATION

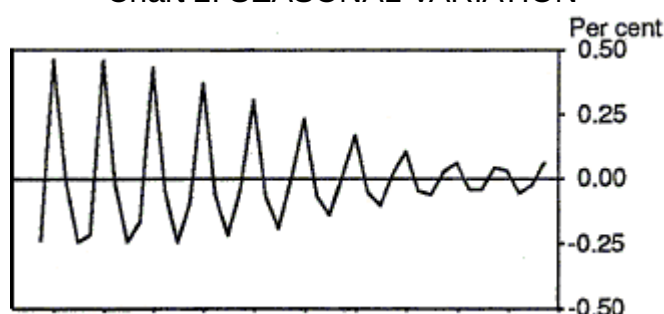


Chart 3. SEASONALLY ADJUSTED SERIES

Chart 4. RESIDUAL/IRREGULAR VARIATION

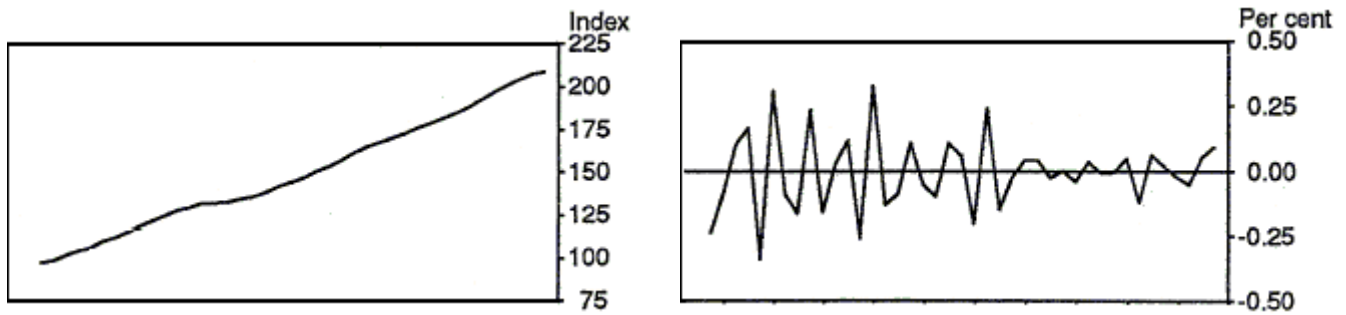
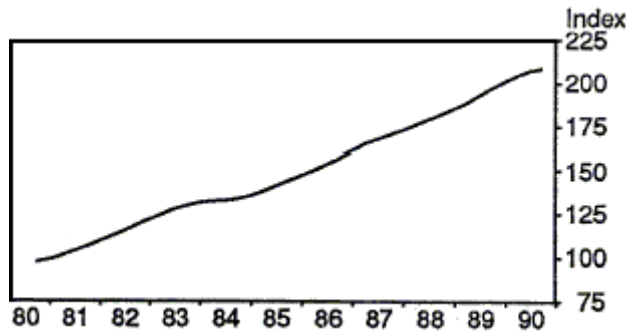


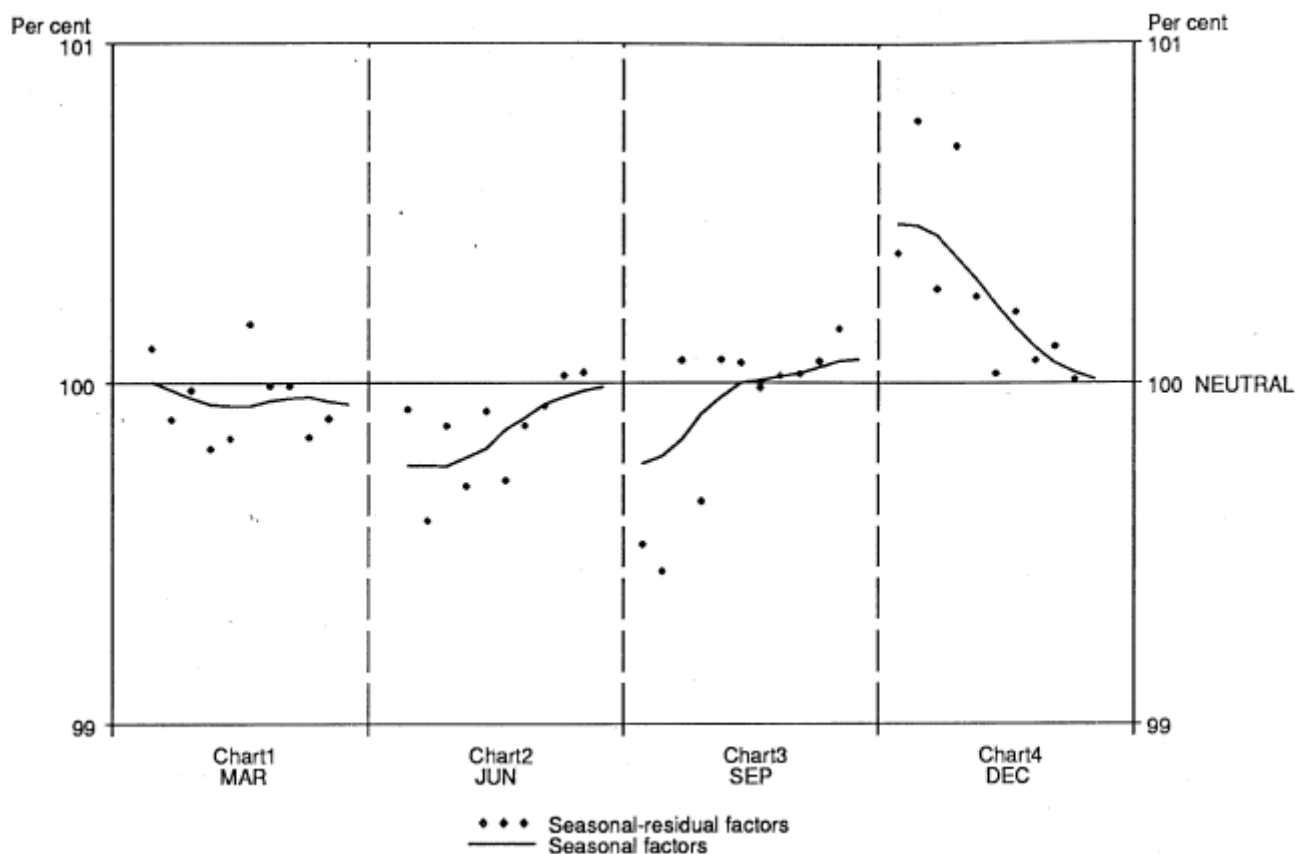
Chart 5. TREND SERIES



3. Chart 2 displays the features of the seasonal pattern that repeats each year. IT can be seen, however, that the seasonal pattern has been weakening each year. The changing strength of this seasonal pattern can also be seen from the scatter diagrams of Graph 2, which shows for each calendar quarter the behaviour of seasonal and residual/irregular influences, that is, the original data with the trend component removed. Values of the seasonal influences above the neutral line indicate seasonally high quarters, those below are seasonally low.

4. Char 1 of Graph 2 represents all of the March quarter seasonal and residual/irregular influences plotted in time order, one observation per year from 1981. Charts 2, 3 and 4 are presented in a similar fashion for the quarters of June, September and December respectively.

Graph 2. CONSUMER PRICE INDEX SEASONALITY
Period covered September 1980 to September 1990



It can be seen from Graph 2 that generally the March, June and September quarters have been seasonally low periods for the CPI, with the seasonal trough being the greatest in the early 1980s. Over time, however, the seasonal troughs have become less marked. Presently all quarters are neither noticeably seasonally high or low periods - they are nearly neutral.

5. Chart 4 of Graph 2 clearly shows that the December quarter has been the seasonally highest period for the CPI. In 1980 the seasonal peak was a maximum of about 1/2 of the one percentage point of the trend level. Over time, however, this peak has diminished to its present neutral value.

6. If these estimates of seasonality are removed from the original data the seasonally adjusted series is produced as plotted in Chart 3 of Graph 1. On average the absolute percentage change each quarter of the seasonally adjusted series is 1.94 compared to that of the original series in Chart 1, which is 1.96. This demonstrates that generally the seasonal influence is not strong.

7. Within the seasonally adjusted series there is the influence of both the trend and residual/irregular factors, the latter displayed in Chart 4 of Graph 1. From this chart it can be seen that the residual/irregular influences have been generally smaller than those of the seasonal pattern (Chart 2, Graph 1). The average absolute percentage change quarter to quarter of the seasonal factors compared to that of the residual/irregular is 0.22 to 0.21. It can also be seen that from about mid 1986 to residual/irregular influence has become considerably smaller.

8. Examination of the spread of the scatter about the seasonal paths in the Charts of Graph 2 discloses which quarters have been the most erratic. Generally the December quarter is the most volatile period, followed equally by June and September, with March the least erratic period. The Charts of Graph 2 also show the periods in which the decreasing volatility has occurred, and the extent of this change.

9. When the influence of the residual/irregular factors is removed from the seasonally adjusted series an estimate of trend is produced, as plotted in Chart 5 of Graph 1.

The variability of the trend series in this case is not generally very different from that of the seasonally adjusted series. The average absolute percentage change of the trend series compared to that of the seasonally adjusted series is 1.93 to 1.94. Generally the trend accounts for 98% of the original CPI mean quarterly variation.

10. While Graphs 1 and 2 illustrate the characteristics of the trend, seasonal pattern and residual/irregular effects within the CPI, the growth decomposition table presented above quantifies these effects. It shows the contribution that each makes to the quarterly percentage changes in the analytic CPI series.

Table 1. GROWTH DECOMPOSITION

		Col 1 Original Series (a)	Col. 2 Seasonal variation	Col. 3 Smoothed Adjusted Trend series T	Col. 4 Residual/irregular variation R	Col. 5 Seasonally adjusted series A = O - S (b)
		O = S + T + R (b)	S	T	R	A = O - S (b)
1980	December	2.1	0.7	1.2	0.2	1.3
1981	March	2.3	-0.5	2.6	0.2	2.8
	June	2.3	-0.2	2.5	0.1	2.5
	September	2.0	0.0	2.5	-0.5	2.0
	December	4.2	0.7	2.8	0.7	3.5
1982	March	1.7	-0.5	2.6	-0.4	2.2
	June	2.4	-0.2	2.7	-0.1	2.6
	September	3.5	0.1	3.0	0.4	3.4
	December	3.0	0.6	2.7	-0.4	2.3
1983	March	2.2	-0.5	2.5	0.2	2.7
	June	2.1	-0.2	2.2	0.1	2.3
	September	1.6	0.2	1.9	-0.4	1.5
	December	2.4	0.5	1.3	0.6	1.9
1984	March	-0.4	-0.4	0.5	-0.5	0.1
	June	0.2	-0.2	0.3	0.0	0.4
	September	1.3	0.2	0.9	0.2	1.1
	December	1.4	0.3	1.2	-0.2	1.1
1985						

	March	1.4	-0.4	1.8	0.0	1.8
	June	2.4	-0.1	2.3	0.2	2.5
	September	2.2	0.2	2.1	0.0	2.0
	December	2.0	0.2	2.0	-0.3	1.8
1986	March	2.3	-0.3	2.2	0.4	2.6
	June	1.7	-0.1	2.1	-0.4	1.7
	September	2.6	0.1	2.3	0.1	2.5
	December	2.9	0.2	2.6	0.1	2.7
1987	March	2.0	-0.2	2.2	0.0	2.2
	June	1.6	0.0	1.7	-0.1	1.6
	September	1.7	0.1	1.5	0.0	1.6
	December	1.7	0.1	1.7	0.0	1.6
1988	March	1.7	-0.2	1.8	0.1	1.8
	June	1.6	0.0	1.7	0.0	1.7
	September	1.7	0.1	1.6	0.0	1.6
	December	1.7	0.0	1.6	0.1	1.7
1989	March	1.6	-0.1	1.9	-0.2	1.7
	June	2.4	0.0	2.3	0.2	2.4
	September	2.3	0.1	2.2	0.0	2.2
	December	1.9	0.0	1.9	0.0	1.9
1990	March	1.7	-0.1	1.8	0.0	1.8
	June	1.6	0.0	1.5	0.1	1.6
	September	0.7	0.1	0.6	0.0	0.6

(a) The CPI Analytic series is used. Refer to ABS Catalogue No. 6442.0 for further details about this series.

(b) Due to the method of calculation and rounding these relationships will not always exactly hold.

11. In column 1 of Table 1 the quarterly percentage changes of the original CPI are recorded, In columns 2, 3 and 4 the contribution in percentage point form is given for the seasonal, trend and residual/irregular components respectively. The latter two items also account for the movements of the seasonally adjusted series presented in column 5.

12. From the decomposition table it can be seen that the seasonal pattern (column 2) has contributed the most to rises in the CPI in the December quarters. Its contribution has, however,

been declining, having been 0.7, 0.7, 0.6, 0.5, 0.3, 0.2, 0.2, 0.1, 0.0, 0.0 of a percentage point from 1980 to 1989. Its contribution in 1990 cannot be expected to be appreciably different from the previous year.

13. Similarly, it can be seen that the biggest seasonal falls have been in the March quarters, and that these falls have also diminished, having been -0.5, -0.5, -0.5, -0.4, -0.4, -0.3, -0.2, -0.2, -0.1, -0.1 of a percentage point from 1981 to 1990.

14. An inspection of the contributions of the residual/irregular variation (column 4) displays the erratic nature of this component. Consider the December quarter movements from 198 to 1989, which have been 0.2, 0.7, -0.4, 0.6, -0.2, -0.3, 0.1, 0.0, 0.1, 0.0. This component is the opposite of the seasonal pattern discussed above, it varies in an unpredictable fashion, whereas the seasonal pattern is gradually changing. An inspection of the residual/irregular variation indicates that the volatility of the series has declined noticeably from about June 1984, and has been a small contributor since September 1986.

15. While there is no reason to suppose a change in the contribution from seasonal variation during 1991, the irregularity of the series, by its nature, could change at any time.

16. It is evident from the decomposition table that the trend component is the major mover of the CPI each quarter. This is clearly seen by comparing column 1 with column 3.

17. While some component prices of the CPI may be seasonal it is evident from this analysis that such seasonal elements must tend to cancel each other in the aggregate.

18. Given the lack of strong seasonality in the CPI the practice of some analysts and commentators of modifying the CPI for alleged seasonality appears unnecessary. Some of these attempts are also excessive because they remove from the CPI not only the alleged seasonality of the component but its trend and residual/irregular attributes as well.

CONCLUSION

From the empirical evidence it can be seen that for the CPI:

1. what net seasonality existed has been fading over the years and is not strong;
2. generally the irregularity of the series has been relatively small and has also tended to diminish noticeably in the last few years;
3. the trend behaviour generally determines most of the CPI's movements.

FURTHER INFORMATION

For further information, contact John Zarb, Time Series Analysis, ABS, on (02) 6252 6103 with any queries or comments.

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